

Electrifying Roller-Coaster Ride through Speed Breakers

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ABSTRACT

This is a electronics based researchpaper on electricity generation through speed breakers.This project produces energy from speed breakers by making use of roller arrangement and electronic circuits.Large amount of energy can be generated through this method.It will prove beneficial to the government if implemented.It is based on the principle of conversion of potential energy to kinetic energy and finally into electrical energy.There are three mechanisms to generate electricity through speed breakers viz., Rack & Pinion mechanism,Crank Shaft mechanism, Roller mechanism.In this paper Roller Mechanism is being explained.

General Terms

electricity generation, quick production of electricity.

Keywords

dc: direct current, ac: alternating current, generation, dynamo, transmission

1. INTRODUCTION

In this modern era electricity has become one of the basic amenities for survival. Man is totally dependent on electronics nowadays. Consumption of electricity in India is growing day by day and there are very less resources to meet the demands of the people because consumption is very much greater than the supply.

Some of the highlights of the current power production status in India:

- India's current installed capacity (end of 2010): 1,70,229 MW, from all sources
- Power generation capacity is mainly based on thermal and hydro, with about 11% from renewable energy.
- In 2010, peak power shortage was 12 %.
- Electricity demand is expected to rise by 7.4%.

According to Central Electricity Authority(CEA) by the year 2008 India's electricity demand was 124GW out of which only 96GW could be supplied. So, alternative methods need to be incorporated to meet the electricity demands and also to lighten up the burden on non- renewable resources.

The idea to generate electricity through speed breakers can bring a renaissance in field of power consumption. TheGovernment will also be able to cope up with the energy crisis as this method is economic and easy to implement.

2. MECHANISM

As the vehicle moves over the roller the gear arrangement attached to the roller comes into motion. The rotation of larger gear attached to the roller causes the smaller gear to rotate. One rotation of the larger gear is equal to five rotations of the smaller gear.

The smaller gear of the gear arrangement is attached to the dynamo. The dynamo here is used to convert the rotational energy into electrical energy.

A rectifier circuitry is being used to convert ac into dc. The electrical energy is then stored into the battery which is connected to the inverter circuitry.

Finally through this arrangement we can obtain a maximum of 15 W power supply.

3. EXPERIMENTAL SETUP

An iron roller is fixed on a wooden ramp on which vehicle passes. As vehicle passes over it, it starts moving. A gear arrangement is provided which transfers the motion to a dynamo for the generation of electricity, as in Fig 1.



Fig 1: Experimental Setup

4. EQUIPMENTS USED

4.1 Gear Arrangement

A gear arrangement is a rotating machine part having cut teeth or sprockets with one gear resting or moving over the other gear in order to transmit torque. Two or more gears can work in tandem. Such gear system is known as transmitting gears and can produce a mechanical advantage through a gear ratio and thus may be considered a simple machine. Gearing devices can also be used along with a non-rotating toothed part called rack thereby producing translation instead of rotation.

4.2 Battery

It is used for the storage of electrical energy generated by the dynamo. Here we have used dry cell battery. Dry cell batteries are those that have electrolyte in a paste form and have just enough moisture for the current to pass.

4.3 Rectifier

A rectifier is one which removes the ac ripples from dc output. It is employed in this project to enhance the efficiency of the system. Rectifiers have many uses, but are often found serving as components of DC power supplies and high-voltage direct current power transmission systems.

4.4 Dynamo

A dynamo is an electromechanical device that converts electrical energy to mechanical energy in the form of alternating current. In principle, a dynamo is used to convert ac into dc through a commutator. Most dynamos use a rotating magnetic field with a stationary armature. Occasionally, a rotating armature is used with a stationary magnetic field. See fig 2.

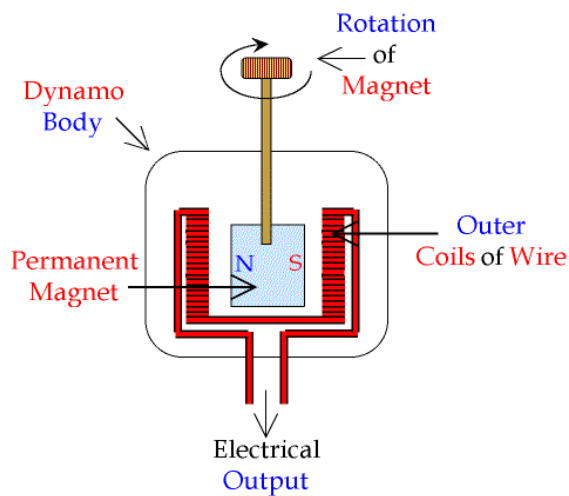


Fig 2: Dynamo

4.5 LED

Light emitting diode (LED) is basically a P-N junction semiconductor diode particularly designed to emit visible light. The LEDs are made in the form of flat tiny P-N junction enclosed in a semi-spherical dome-like case made up of clear coloured epoxy resin. The dome of a LED acts as a lens and diffuser of light.

4.6 Inverter

It is used to convert dc into ac. The converted ac can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits. The inverter performs opposite function of the rectifier.

4.7 Transformer

A transformer is a static electrical device that operates on the principle of Faraday's Law of Electromagnetic Induction. It consists of two windings: primary and secondary. Here a step-up transformer is used.

Table 1. Specifications of Wooden Ramp

Sr. No.	Parts	Dimensions(mm)
1	Wooden Board	480*250
2	Platform	245*120
3	Thickness of Board	18

Table 2. Specifications of Metal Roller

S. No.	Parts	Dimensions(mm)
1	Outside diameter of roller	140
2	Inside diameter of roller	130
3	Length of roller	305
4	Diameter of shaft	30

5. BLOCK DIAGRAM

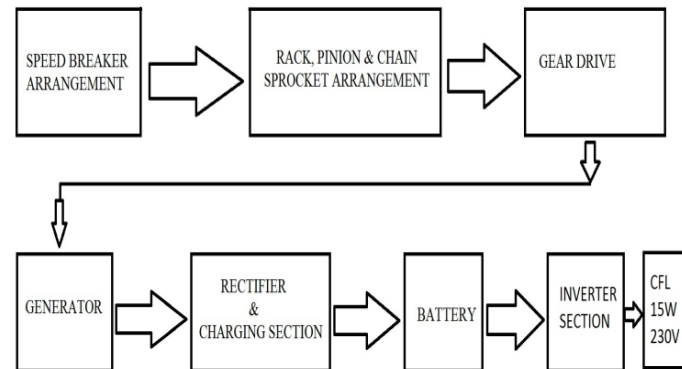


Fig 3: Block Diagram of Generation of Electricity from Speed Breakers

6. MATHEMATICAL MODELLING

ω_1 = Angular Speed of Vehicle Tire (rad/sec)

ω_2 = Angular Speed of Roller (rad/sec)

d_1 = Diameter of Tire (mm)

d_2 = Diameter of Roller (mm)

v = Velocity of Vehicle (m/sec)

r = Radius of wheel (mm)

I = Moment of Inertia of Roller (pipe)

d_o = Outside Diameter of Roller (mm)

d_i = Inside Diameter of Roller (mm)

V = Voltage (volts)

I = Current (Ampere)

T = Time (seconds)

R = Rotational Kinetic Energy of Roller (Joules)

E = Electrical Energy (Joules)

And,

Linear velocity, $v = r * \omega$

Moment of Inertia of Roller, $I = (\pi * (d_o - d_i)) / 64$

Rotational Kinetic Energy of Roller, $R = (I * (\omega_2)^2) / 2$

Electrical energy, $E = V * I * T$.

Efficiency, $\eta = E / R$

Table 3. Summary of Experiments Carried out on Electrical Apparatus

S.No.	Rotational Kinetic Energy of Roller(J)	Vol(V)	Current(A)	Time(sec)	Electrical Energy(J)	Efficiency
1	4541	5	0.8	4	16	0.4
2	6469	5.5	1	4	22	0.45
3	10057	6.4	1.2	4	31	0.48

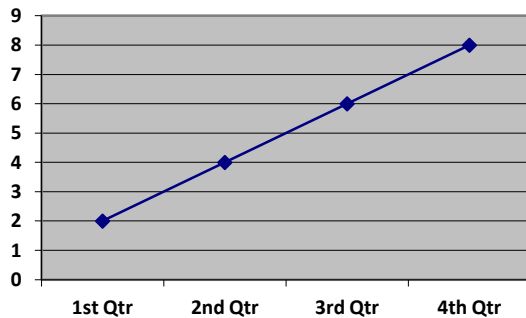


Fig 4: Graph of energy versus velocity

7. CONCLUSION

This project will prove a great boon to the world as it serves the need of the hour i.e. electricity. It will specially be good for the developing countries which are suffering with energy-crisis. The simple approach of the project can be used to harness immense amount of electricity. For countries like India where rural development is still not at its pace, this idea is of utmost worth. It can be used for power supply into the remote areas, lighting the street lamps. It can be well employed on highways and the energy thus stored can be utilized in several ways.

This project has some advantages which are:-

- The project is economical and easy to install.
- This project is non polluting.
- Maintenance cost is low.
- Installation cost is low.

This project has certain disadvantages also such as:

- Rain water may cause damage to the components.

8. FUTURE ENHANCEMENT

There are certain enhancements which may lead to the efficiency of the project & will also help in improving rate of power generation. Following are some enhancements:

- Increasing the number of rollers can generate upto 1000W electricity.
- Using sprocket arrangement will produce 100W of power.
- If the same arrangement is used on the next side of the roller then with the help of this setup power of 500W can be created.

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